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Moral Concerns across the United States: Associations with Life-history Variables, Pathogen Prevalence, Urbanization, Cognitive Ability, and Social Class

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Abstract

This study evaluated the extent to which predictions derived from several theories could account for variability in human moral values across US states. We investigated moral values as conceptualized by Moral Foundations Theory, which argues that morality evolved in response to adaptive challenges in at least five domains: Ingroup/loyalty, Authority/respect, Purity/sanctity ("binding" foundations) and Harm/care, Fairness/reciprocity ("individualizing" foundations). We report correlations for measures of cognitive ability, social class, urbanization, pathogen prevalence, life expectancy, and teenage birth rates. Social class and educational attainment had fairly consistent but small effects across moral foundations (social class: positively associated with Ingroup/loyalty, negatively with individualizing foundations and Purity/sanctity; education: positively associated with individualizing foundations, negatively with binding foundations). We conducted multilevel regressions that were stratified for ethnicity. The most consistent state-level predictor of moral values was teenage birth rates (negatively associated with individualizing foundations, positively with binding foundations). This suggests that life-history theory may provide an explanation for individual differences in moral values, although the directions of effects for teenage birth rates diverged from predictions of life-history theory. We conclude that none of the tested theories provides a good explanation for the observed variability in moral values in the USA. We discuss how a life-history approach might account for the findings, and note the need for improved measurement of pathogen stress to better distinguish its effects from those of life-history variables.

Keywords: behavioral immune system; life expectancy; life-history theory; moral foundations; morality; pathogen prevalence; teenage birth rate

1. Introduction

People everywhere are concerned with morality, but exactly what people find moral, immoral, or amoral varies widely around the world. In some societies, individual welfare and justice are prioritized; in other societies, values relevant to intragroup and interpersonal harmony (such as loyalty and deference) are considered just as important. Is there any pattern to this variation? According to Moral Foundations Theory, human moral values are grounded in at least five intuitive foundations, each related to a distinct evolutionary problem (Graham et al., 2013). Two of them – concern for Harm and Fairness – are the focus of liberal ethics and are referred to as *individualizing foundations*. The other three – concern for Ingroup, Authority, and Purity – tend to be endorsed more by conservatives and are referred to as *binding foundations* (Graham, Haidt, & Nosek, 2009). Research has revealed a great deal of variability in endorsement of the moral foundations across societies and across individuals within a given society. This variability has been found to be systematic, being associated with a number of ecological, historical, and personality variables. Typically, the variation is greatest for the binding foundations, with some individuals/societies endorsing them as much as the individualizing foundations and others assigning much lower moral relevance to them. In the present research, we focused on variation in the endorsement of the moral foundations across the states of the USA. We considered several theories and empirical findings – specifically regarding cognitive ability, urbanization, social class, pathogen prevalence, and life-history strategy – to identify potential explanatory variables. In sections 1.1-1.5 we specify the empirical predictions regarding moral foundation valuation derived from these five approaches (for an overview, see Table 1).

1.1 Cognitive ability

Cognitive ability may be related to moral values. Kohlberg (1984) proposed an approach in which moral reasoning is hypothesized to go through a stage-based developmental process. He reported that moral maturity—i.e., the stage of moral reasoning attained by an individual—correlated in the range of .30 to .50 with group IQ test scores at age 12 across studies. However, Kohlberg also noted that the relationship between IQ and moral maturity is somewhat more complicated (see Table 1, prediction 1):

> In fact, a curvilinear relation between IQ and moral maturity is found. In the below-average range, a linear correlation (r = .53) is found between IQ and moral maturity, whereas no relationship (r = .16) is found between the two measures in the above-average group. (p. 64)

Kohlberg argued that this dissociation exists because the terminal status of moral maturity results from social experience rather than IQ. As higher-stage post-conventional moral reasoning is characterized by emphasis on individual's rights and wellbeing (e.g., Kohlberg & Hersh, 1977), and as such concerns are associated with the individualizing foundations (Haidt & Kesebir, 2009), a positive correlation between cognitive ability and moral maturity would be indicated by a positive correlation between cognitive ability and endorsement of the individualizing foundations (see Table 1, prediction 1). Regardless of the exact relations between IQ and stages of moral maturity, multiple studies have shown findings consistent with an effect of cognitive ability or education on moral values. For example, less education is associated with greater political conservatism (Sidanius, Pratto, & Bobo, 1996), and lower cognitive ability (as measured by aptitude test scores) is associated with stronger conservative values (Stankov, 2009). Furthermore, a large developmental study in the UK has shown that higher general intelligence in childhood is associated with more liberal and less traditional social attitudes in adulthood (Deary, Batty, & Gale, 2008; see Table 1, predictions 2a and 2b). In sum, these findings suggest that cognitive ability may be a predictor of moral values. Therefore, we evaluated whether cognitive ability (as indicated by education completed) can explain variation in endorsement of the moral foundations.

1.2 Urbanization

Several researchers have suggested that urbanization (i.e., the proportion of people in a region living in cities) may be associated with a certain pattern of moral values. For example, cross-cultural psychologists have proposed that urbanization is related to individualism rather than collectivism (Triandis, McCusker, & Hui, 1990). Researchers who study moral psychology have expressed a similar notion (see Table 1, predictions 3a and 3b):

> The free and open social order of a big Western city is a moral system…just as is the more binding and constricting social order of a small Indian village. The suppression of selfishness in a big city may rely more upon padlocks, police, and norms of non-interference than on caste, gossip, and norms of respect. (Haidt & Kesebir, 2010, p. 800)

In support of the idea that the morality of people in large and small communities differ, recent cross-cultural research on economic behavior (i.e., decisions in economic games) has found that increased community size is associated with tendencies to reject unfair offers by others and tendencies to punish those who make unfair offers (Henrich et al., 2010). For larger communities, the increased cultural diversity may make moral norms about group boundaries and rigid social hierarchies less viable, and so care and fairness at the level of the individual (rather than the group) may become more of the moral focus. Thus, larger community size is predicted to be associated with greater support for the individualizing foundations and lower support for the binding foundations (see Table 1, predictions 3a and 3b).

1.3 Social class

Moral values may also be associated with social class. Researchers have suggested that the different availability of resources for individuals of different social classes may influence diverse aspects of behavior and psychology, including moral values (Kraus, Piff, Mendoza-Denton, Rheinschmidt, & Keltner, 2012). Availability of resources may be associated with social class or socioeconomic status, with lower social class being associated with less education, less income, and lower perceived social rank (Kraus et al., 2012). Studies have shown socioeconomic status or social class to be associated with moral judgments (Haidt, Koller, & Dias, 1993; Horberg, Oveis, Keltner, & Cohen, 2009) and unethical behavior (Piff, Stancato, Côté, Mendoza-Denton, & Keltner, 2012). Kraus et al. (2012) formulated hypotheses regarding the relations between social class and moral values. Specifically, they predicted that lower social class would be associated with moral values emphasizing Harm, Fairness, and Purity, whereas higher social class would be associated with moral values emphasizing Authority (see Table 1, predictions 4a, 4b, 4c, and 4d).

1.4 Pathogen prevalence

Pathogens have led to the evolution of physiological defenses. It has been proposed that animals may also have evolved a *behavioral immune system* – a set of behavioral mechanisms that facilitate the avoidance of pathogens (Curtis & Biran, 2001; Kurzban & Leary, 2001; Loehle, 1995; Schaller & Park, 2011). At the psychological level, perceived disease threat reduces self-perceived extraversion (Mortensen, Becker, Ackerman, Neuberg, & Kenrick, 2010), and enhances xenophobia and ethnocentrism (Faulkner, Schaller, Park, & Duncan, 2004; Navarrete & Fessler, 2006), negative attitudes toward physically non-normative individuals (Park, Faulkner, & Schaller, 2003), intentions to use condoms (Tybur, Bryan, Magnan, & Caldwell Hooper, 2011), and perceived danger of disease-related animals

(Prokop, Usak, & Fančovičová, 2010). A meta-analysis of 24 studies indicated that disgust sensitivity and fear of contamination predict many forms of social conservatism, such as right-wing authoritarianism and collectivism (Terrizzi, Shook, & McDaniel, 2013).

In addition to these individual-level reactions that may serve to neutralize pathogen threat, certain cultural patterns appear to reflect adaptive responses to pathogens, an idea known as the *parasite-stress model*. Pathogen prevalence – how much exposure a society has had to infectious diseases – is positively correlated with culture-level measures of authoritarianism (Murray, Schaller, & Suedfeld, 2013), religious diversity (Fincher & Thornhill, 2008), collectivism (Fincher, Thornhill, Murray, & Schaller, 2008), and conformity (Murray, Trudeau, & Schaller, 2011), whereas it is negatively correlated with democracy (Thornhill, Fincher, & Aran, 2009), sociosexuality, extraversion, and openness to experience (Schaller & Murray, 2008).

These cross-cultural manifestations of adaptation to pathogen threat appear to extend to moral psychology. Van Leeuwen, Park, Koenig, and Graham (2012) hypothesized that endorsement of the binding foundations would be enhanced in cultures with a higher prevalence of pathogens. This is because binding morals may help protect against out-group members who harbor novel pathogens and prevent unconventional actions within the group that could increase risk of infection. Analysis of data from 82 countries supported this hypothesis. The binding foundations – but not the individualizing foundations – were endorsed more strongly in regions that historically have had higher levels of pathogens. Thus, one possibility is that pathogen prevalence across states is associated with endorsement of the binding moral foundations (see Table 1, prediction 5).

1.5 Life-history strategy

Life-history theory suggests that animals (including humans) strategically adapt during development to the local ecology. In unstable and dangerous environments, animals adopt a faster life-history strategy by investing in reproduction and focusing on short-term outcomes. In stable and safe environments, animals adopt a slower life-history strategy by investing in somatic development and focusing on long-term outcomes (Kaplan & Gangestad, 2005). Variables associated with life-history strategy, such as investment in mating and indicators of extrinsic risk (e.g., Hill & Kaplan, 1999), may explain an observed relation between pathogen prevalence and moral preferences. Indeed, recent research by Hackman and Hruschka (2013) showed that, across the USA, controlling for life-history variables resulted in non-significant correlations among pathogen prevalence and the variables theoretically related to it. Specifically, when controlling for teenage birth rate and ethnicity as measures of faster life-history strategy and extrinsic risk, respectively, pathogen prevalence no longer predicted variation in homicide, child abuse, and strength of family ties across states (cf. Fincher & Thornhill, 2012; Thornhill & Fincher, 2011). Faster life-history strategy is expected to be associated with higher teenage birth rate and shorter life expectancy. Therefore, we tested whether life-history variables predicted moral values by including teenage birth rate (as a measure of faster life-history strategy), life expectancy (as a measure of safety of the environment), and conducting ethnicity-stratified analyses. For individuals living in the USA, ethnicity is indicative of a broad range of risks and uncertainties (e.g., infant mortality and homicide; Arias, MacDorman, Strobino, & Guyer, 2003; Xu, Kochanek, Murphy, & Tejada-Vera, 2010) and is associated with discrepancies in life expectancy (Harper, Lynch, Burris, & Smith, 2007). Analyses that aggregate across ethnicity may thus

confound ethnicity with variables related to risk and uncertainty (Hackman & Hruschka, 2013).

Theories diverge regarding how life-history strategy relates to moral values. Thornhill and Fincher (2007) proposed that conservative ideology reflects in-group specialization, a consequence, they suggest, of secure attachment which in turn results from low risk exposure during childhood. Given the associations of political orientation with moral foundations (Graham, et al., 2009), this approach suggests that slower life-history strategy should be associated with stronger endorsement of Ingroup, Authority, and Purity, but weaker endorsement of Harm and Fairness (see Table 1, predictions 6a and 6b). In contrast, Gladden, Welch, Figueredo, and Jacobs (2009) proposed that individuals adopting a slower life-history strategy benefit from generating stable social environments by moralizing social interactions generally and that such a strategy should correlate positively with endorsement of all moral values (see Table 1, predictions 7a and 7b). Both approaches predict that slower life history correlates positively with the binding foundations, but the approaches generate competing predictions about how life history correlates with the individualizing foundations.

1.6 Current study

The goal of the current study was to assess support for the predictions summarized in Table 1. We therefore tested the predictive ability of multiple variables on the endorsement of moral foundations across states of the USA. This involved multilevel analyses including state-level predictors (i.e., pathogen prevalence, urbanization, teenage birth rate, and life expectancy) and individual-level predictors (i.e., education and childhood social class).

Following Hackman and Hruschka (2013), we controlled for ethnicity by conducting separate analyses for non-Hispanic Whites and Blacks.

2. Method

Data on moral values were obtained from 86,296 adult visitors to the website YourMorals.org who completed the Moral Foundations Questionnaire (MFQ; Graham et al., 2011; see supplement S1). For all states, moderate sample sizes were available (individual state *n*s ranged from 106 to 11,995; mean n = 1,726, SD = 2,103). Average endorsement scores for the five moral foundations were computed for all states (range of mean scores: Harm 3.35–3.63, Fairness 3.41–3.68, Ingroup 2.15–2.52, Authority 2.13–2.56, Purity 1.43–2.05). Subsamples of these volunteers also provided data on political conservatism (7-point scale from *very liberal* to *very conservative*), education (9-point scale from *some high school* to *completed graduate or professional degree*), childhood social class (4-point scale from *working class* to *upper class*), and ethnicity (10 options: *Black*, *East Asian*, *Latino*, *Middle Eastern*, *Native American*, *South Asian*, *White*, *Mixed race*, *Other*, and *Decline to answer*). Data from the subsamples of White (N = 21,423) and Black (N = 1,016) participants were used in the multilevel analyses.

2.1 Individual-level predictors

The individual-level correlation between education and childhood social class was small, r (N = 39,668) = .14, $p < .001$. Any effects of social class on moral foundation endorsement scores should thus be mostly independent of those of education.

Individual-level data on political conservatism were available, but including this variable may obscure the effects of the other predictors, as political conservatism is correlated highly with scores for all moral foundations (see supplement S2) and is likely to be an outcome of foundation endorsement as well as being a contributor (Graham et al., 2009; Koleva, Graham, Iyer, Ditto, & Haidt, 2012; see also King & Zeng, 2007). Therefore, we excluded political conservatism from analyses.

2.2 State-level predictors

We obtained state-level data for urbanization, pathogen prevalence, and life-history variables. Data on urbanization for all 50 states were obtained from the US Census Bureau (http://www.census.gov/geo/www/ua/2010urbanruralclass.html#percent). The US Census Bureau computed urbanization as the percentage of state population according to the 2010 census living in urban areas (i.e., census blocks or tracts with at least 2,500 residents; see http://www.census.gov/geo/reference/ua/urban-rural-2010.html). Urbanization percentages ranged from 38.7 to 95.0 (M = 73.6, SD = 14.6).

For all 50 states, data on pathogen prevalence were obtained from Hackman and Hruschka (2013), who critiqued the pathogen prevalence measure provided by Fincher and Thornhill (2012). To estimate state-level pathogen prevalence, Fincher and Thornhill used data from the US's Centers for Disease Control for the set of infectious diseases monitored for all states for the years 1993–2007. The monitored set of diseases differed across years (e.g., for 1993, the set included 47 diseases; for 1998, the set included 22 diseases), but for all years the set included AIDS, haemophilus influenzae, malaria, measles, meningococcal disease, pertussis, salmonellosis, shigellosis, syphilis, tuberculosis, and typhoid fever. For

each year, the number of cases of disease was controlled for state population. Hackman and Hruschka (2013) showed that Fincher and Thornhill's (2012) pathogen prevalence measure largely reflects two sexually transmitted diseases (STDs): Chlamydia and Gonorrhea. We thus used Chlamydia and Gonorrhea (C&G) rates (1998–2009) for non-Hispanic Whites (range 35.06–357.10) and Blacks (range 890.00–3978.06) from Hackman and Hruschka (2013) as a measure of pathogen prevalence.

We also obtained data for variables related to life-history strategy. Teenage birth rates (i.e., number of births per 1,000 women aged 15–19) for 2005 were obtained from the Guttmacher Institute (www.guttmacher.org/pubs/USTPtrends.pdf). Teenage birth rates ranged from 8–49 (M = 27.54, SD = 9.74) for non-Hispanic Whites and from 23–92 (M = 59.33, SD = 16.60, available for 45 states only) for Blacks. Life expectancy at birth estimates for 2008–2009 were obtained from www.measureofamerica.org, whose estimates are based on data from the Centers for Disease Control and Prevention, National Center for Health statistics. Life expectancy estimates ranged for non-Hispanic Whites from 75.2–80.5 (M = 78.04, SD = 1.45) and for Blacks from 70.2–77.2 (M = 73.18, SD = 1.71; available for 37 states only). For correlations between state-level variables, see supplement S3, Table S3.

3. Results

Across the fifty states of the USA, endorsement scores of non-Hispanic Whites for Fairness, Ingroup, Authority, and Purity correlated significantly with life expectancy and teenage birth rate (see Table 2). Consistent with previous analyses of ethnicity-stratified pathogen prevalence (Hackman & Hruschka, 2013), Whites' C&G rates did not correlate significantly with endorsement of any foundation. Urbanization correlated negatively with

Purity. Of the individual-level variables, both education and social class showed significant correlations with foundation endorsement (see Table 2). Scatter plots were examined to assess whether the associations between education and endorsement of the individualizing foundations was curvilinear as described above (i.e., positive for lower range of education, no association for higher range of education; prediction 1). There was no such pattern. Correlations between endorsement of the moral foundations and education (predictions 2a and 2b) and social class (predictions 4a, 4b, and 4c) were in the predicted direction, but very small.

To assess the unique effects of each variable, we conducted multilevel analyses. Hackman and Hruschka (2013) showed that stratification by ethnicity (i.e., separate analyses for non-Hispanic Whites and Blacks) eliminated the predictive effects of pathogen prevalence. We therefore conducted separate multilevel analyses for non-Hispanic Whites (see Table 3) and Blacks (see below). Endorsement scores for each of the five moral foundations were analyzed with separate hierarchical linear regressions (using maximum likelihood estimation and IBM SPSS Statistics 19). Non-Hispanic White participants who had provided demographic data on education and childhood social class (N = 21,423) were nested within states. At Level 1 (i.e., the individual level), education and childhood social class (both group-mean centered) predicted individual-level variation in moral foundation endorsement. At Level 2 (i.e., state-level), C&G rates, urbanization, teenage birth rates, life expectancy (all grand-mean centered), and state-averages for education and childhood social class predicted variation in state means of moral foundation endorsement. Initially, all variables were included in the models with intercepts and slopes allowed to vary across states. Nonsignificant (i.e., $p > .10$) effects were then excluded one-by-one, starting with effects of random slopes, then fixed effects of the predictors. (Effects for education and social

class were only excluded if both Level-1 and Level-2 effects were non-significant.) VIFs did not exceed the rule-of-thumb value of 10, indicating that multicollinearity was not a problem (see supplement S4). Table 3 shows the models with significant and marginal predictors of moral foundation endorsement scores.

These analyses showed that among non-Hispanic Whites, teenage birth rate predicted endorsement of all foundations, showing positive associations with the binding foundations and negative associations with the individualizing foundations. Life expectancy did not predict endorsement of any foundation, but this may be because for non-Hispanic Whites it was confounded with teenage birth rates, r (N = 50) = -.84, p < .001. Urbanization negatively predicted only endorsement of Harm. C&G rates negatively predicted endorsement of Ingroup, Authority, and Purity. In addition, significant Level-2 effects were observed for Education on Fairness, Ingroup, and Purity, such that higher state-average education was associated with higher endorsement of Fairness, but lower endorsement of Ingroup and Purity. Significant Level-1 effects were observed for Education for all foundations except Ingroup (but in terms of explained Level-1 variance, these effects were small). Significant Level-2 effects were observed for Social class on Harm and Fairness, such that higher state-average Social class was associated with lower endorsement of Harm and Fairness. Significant Level-1 effects were observed for Social class for all foundations except Authority (as with Education, these effects were small).

For the analyses involving Blacks, including Education and Social class yielded N = 351. Null models showed that this sample yielded no significant between-state variability. Therefore, Education and Social class were excluded from these analyses, giving N = 1,016. Unfortunately, null models (see supplement S5) showed that for this sample, only

endorsement of Authority and Purity varied significantly across states. Analyses indicated that teenage birth rate significantly predicted both Authority (b = 0.0131, SE = 0.0051, $t(18.3) = 2.58$, $p = .019$, Level-2 PRV = .47) and Purity (b = 0.0099, SE = 0.0041, $t(20.5) = 2.42$, $p = .025$, Level-2 PRV = .44). C&G significantly predicted only Authority (b = -0.0002, SE = 0.0001, $t(27.6) = -2.31$, $p = .029$, Level-2 PRV = .37). Other predictors were non-significant.

4. Discussion

In analyses of a large sample of non-Hispanic Whites across states of the USA, state-level teenage birth rates significantly predicted endorsement of the five moral foundations. However, the effects for the binding foundations were in the opposite direction than the predictions derived from a life-history perspective (see Table 1 for a summary of predictions and findings). Nevertheless, this finding suggests that life-history theory might play an important role in explaining variability in endorsement of moral foundations for non-Hispanic Whites, and perhaps other ethnicities. The analyses conducted over the smaller sample of Blacks showed consistent effects of teenage birth rates for endorsement of Authority and Purity. The ethnicity-stratified measure of pathogen prevalence – C&G rates – was negatively associated with endorsement of Ingroup (for Whites) and Authority (for both Whites and Blacks), which is opposite of the prediction derived from the parasite stress model. Urbanization was negatively associated with endorsement of Harm (for Whites). We found consistent – but small – individual-level effects for social class and education on moral foundation endorsement. Overall, this pattern of findings suggests that environmental factors, especially those relating to life-history theory, are important explanatory variables for endorsement of the five foundations.

4.1 Life-history theory

Previous research has shown that endorsement of the moral foundations across countries is associated with pathogen prevalence in those countries (Van Leeuwen et al., 2012). Hackman and Hruschka (2013) suggested that life-history factors may account for effects attributed to pathogen prevalence. To evaluate life-history factors in relation to endorsement of the moral foundations, we included two relevant variables – life expectancy and teenage birth rate. Considering the results for the non-Hispanic White subsample, teenage birth rate and life expectancy were strongly correlated (r = -.84). Unsurprisingly, then, the final models included only one of these variables, teenage birth rate, as a significant predictor. Teenage birth rate significantly predicted endorsement of all five foundations, with state-level PRVs ranging from .39 to .59. For the Black subsample, only Authority and Purity had final models that had sufficient between-state variability to evaluate predictors. For both, teenage birth rate was a significant predictor (respective PRVs = .47 and .44). These findings suggest that life-history variables play an important role in explaining endorsement of the moral foundations for non-Hispanic Whites and for Blacks.

The overall pattern of observed effects contradicted the predictions of Thornhill and Fincher (2007), as well as those of Gladden and colleagues (2009). Rather than faster life history predicting lower endorsement of binding foundations as both accounts predicted, it was associated with higher endorsement of these foundations. For individualizing foundations, our findings contradicted the predictions of Thornhill and Fincher (2007) but were consistent with those of Gladden and colleagues. Gladden and colleagues predicted that faster life history would be associated with decreased Harm and Fairness concerns (Table 1,

prediction 7a), but their theoretical rationale also predicted decreased endorsement of the other three foundations and thus cannot explain the observed relationship.

Thornhill and Fincher's (2007) account of the relation between life-history strategy and conservatism involves a relation between secure attachment style and conservatism. However, findings pertaining to the relation between attachment style and political ideology have been found to be inconsistent (Koleva & Rip, 2009). In addition, contrary to the association between avoidant attachment and liberalism observed by Thornhill and Fincher (2007), recent research suggests that avoidant attachment is associated with lower endorsement of liberal moral values (i.e., lower endorsement of Harm and Fairness; Koleva, Selterman, Iyer, Ditto, & Graham, 2014).

Rather than being driven by attachment style, the relation between life-history strategy and increased endorsement of the binding foundations might be related to the association between fast life-history strategy and increased religiosity observed by Hackman and Hruschka (2013). The group-focused binding moral values seem to play a role in building and maintaining communities (Graham & Haidt, 2010; Haidt & Kesebir, 2010). We speculate that individuals with a faster life-history strategy (resulting from uncertain and dangerous environments or scarce resources) might rely more on family and in-group for support to enable their faster reproductive strategy. Individuals with a faster reproductive strategy might therefore emphasize group-focused binding values and downplay individual-focused concerns of harm and fairness as part of building and maintaining their (religious and non-religious) in-groups.

4.2 Pathogen prevalence

Looking at the correlations for ethnicity-stratified C&G rates, we observed a pattern across US states that is inconsistent with what has been previously observed across countries: Higher pathogen prevalence was not associated with increased endorsement of the binding foundations (cf. Van Leeuwen et al., 2012). However, this lack of association is consistent with findings of previous ethnicity-stratified analysis including pathogen prevalence (Hackman & Hruschka, 2013). Furthermore, the multilevel analyses for non-Hispanic Whites showed a negative relationship between pathogen prevalence (i.e., ethnicity-stratified C&G rates) and endorsement of the binding foundations. For this subsample, more pathogens – specifically STDs – were associated with lower concern for Ingroup, Authority, and Purity, contrary to prediction (Table 1, prediction 5). Although this finding is inconsistent with the parasite-stress model, it is also inconsistent with a life-history strategy account. The effects involving the life-history variable (teenage birth rate) suggest that a faster life-history strategy (higher teenage birth rate) is associated with higher endorsement of the binding foundations, and lower endorsement of the individualizing foundations. However, faster life-history strategy is also expected to be associated with higher – rather than lower – STD rates (cf. Hackman & Hruschka, 2013). Therefore, the negative associations between STDs and endorsement of the binding foundations are also inconsistent with a life-history account.

The current findings run counter to those of Leeuwen et al. (2012). Why this is the case is unclear. Notably, the current measure of pathogen prevalence differed in two key ways from that used across cultures by Van Leeuwen et al. (2012). First, the current measure consisted of two STDs whereas that used by Van Leeuwen et al. (2012) consisted of a diverse set of pathogens. Second, they found that across cultures the binding foundations correlated more strongly with historical than contemporary pathogen prevalence. Estimates of historical

pathogen prevalence were, unfortunately, unavailable for US states. Additional research is required to understand this unexpected difference.

4.3 Social class

The results provide partial support for the relation between socioeconomic status and moral values as hypothesized by Kraus et al. (2012). Consistent with their predictions, childhood social class showed negative associations with endorsement of Harm, Fairness, and Purity. Failing to support their prediction, higher social class was not positively associated with Authority. Kraus et al. (2012) made no predictions regarding social class and endorsement of Ingroup; nevertheless, we found that higher childhood social class was associated with stronger endorsement of Ingroup. It is noteworthy that the associations between childhood social class and foundation endorsement were very small (rs < .08). The current study involved a 4-point scale to measure social class; it is possible that the effects of this variable were reduced due to measurement error.

4.4 Urbanization

The results showed no support for the hypothesis that greater urbanization is associated with increased individualizing morals. Rather, for non-Hispanic Whites urbanization had a negative association with endorsement of Harm.

4.5 Cognitive ability

When looking at correlations for individuals' completed education and moral foundations endorsement, the results are partly consistent with previous research on the relation between cognitive ability and social values. The multilevel analyses showed that, for non-Hispanic Whites, more education was associated with stronger endorsement of individualizing morals and – contrary to Sidanius et al. (1996) – two of the three binding morals. The main finding for education, however, was that effect sizes for associations with moral values were small.

4.6 Limitations

The present study tested several alternative explanations for the variability in endorsement of moral foundations. Although we were partially successful in doing so, some concerns remain. Of course, as the current research was correlational, it is limited in showing support of causal relationships. Another limitation is the extent to which the state-level variables reflected distinct constructs.

Pathogen prevalence is likely one factor influencing life-history strategy (Hackman & Hruschka, 2013), so care is required in distinguishing effects of pathogens and those of other life-history psychological processes. As noted by Hackman and Hruschka, with regard to tests of the parasite stress model, the C&G index suffers from the same issue as Fincher and Thornhill's (2012) estimates of USA state-level pathogen prevalence. As both these indexes focus on STDs, they are likely to reflect both causes of sexually transmitted pathogens (e.g., faster life-history strategy behaviors such as promiscuity) and their effects (e.g., activation of anti-pathogen defenses). In other words, as STDs are pathogens, they are likely to activate anti-pathogen defense mechanisms. However, they are also more common in areas where

people have a faster life-history strategy, so STDs are also expected to correlate with life-history strategy. Unfortunately, our state-level pathogen measure reflected STDs. Future research could clarify this issue by using an alternative pathogen measure that is less influenced by life-history factors, perhaps by focusing on non-sexually transmitted diseases.

4.7 Conclusion

The current findings suggest that multiple ecological factors – including life history-related variables, pathogen prevalence, and availability of resources – underlie variability in moral values, but that current theoretical approaches do not fare well in explaining why this occurs. As predicted, higher cognitive ability was associated with increased endorsement of the individualizing foundations, but effects were very small. Contrary to predictions, increased urbanization was not associated with increased endorsement of the individualizing foundations, or decreased endorsement of the binding foundations. In line with predictions, higher social class was associated with increased endorsement of Harm, Fairness, and Purity, but – like for education – effects were very small. Inconsistent with predictions based on the parasite-stress model, high pathogen prevalence was associated with decreased – not increased – endorsement of the binding foundations. Overall, variables associated with life-history strategy showed general and large effects. However, contrary to predictions, the results suggest that faster life history is associated with increased endorsement of the binding foundations. In order to specify how ecological factors relevant to life-history strategy and parasite stress influence moral psychology, further research may focus on the proximate effects of life-history strategy on moral psychology, and on distinguishing the effects of parasite stress and life-history strategy.

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Table 1. Overview of theories, derived predictions, and support.

Theoretical accounts	Predictions	Supported?
Cognitive ability	1. Curvilinear relation between intelligence and individ endorsement	1. Not supported
	2a. Higher intelligence → higher individ	2a. Supported
	2b. Higher intelligence → lower binding	2b. Mixed support
Urbanization	3a. Higher urbanization → higher individ	3a. Not supported
	3b. Higher urbanization → lower binding	3b. Not supported
Social class	4a. Higher social class → lower Harm	4a. Supported
	4b. Higher social class → lower Fairness	4b. Supported
	4c. Higher social class → lower Purity	4c. Supported (small effects)
	4d. Higher social class → higher Authority	4d. Not supported
Parasite-stress	5. Higher pathogen prevalence → higher binding	5. Not supported
Life-history	6a. Faster life history → higher individ	6a. Not supported
	6b. Faster life history → lower binding	6b. Not supported
	7a. Faster life history → lower individ	7a. Supported
	7b. Faster life history → lower binding	7b. Not supported

Note: See text for how predictions were derived from theoretical accounts and prior findings. For clarity, predictions in this table are formulated as "*higher* values of X is associated with higher/lower values of Y." (The arrows should be read as "is associated with.") Abbreviations: individ = individualizing foundations, binding = binding foundations.

Table 2. Correlations at state and individual levels of the predictors with endorsement scores for the moral foundations.

	Moral foundations				
Variables	Harm	Fairness	Ingroup	Authority	Purity
State-level (*N*s = 50)					
C&G, Whites	-.08	-.14	-.19	-.10	.06
Life expectancy, Whites	.17	.41**	-.39**	-.47**	-.53**
Teenage birth rate, Whites	-.23	-.53**	.33*	.45**	.64**
Urbanization	-.17	.02	-.08	.00	-.30*
Individual-level					
Education, Whites (*N* = 52,805)	.04***	.05***	-.03***	-.01*	-.03***
Social class, Whites (*N* = 22,963)	-.06***	-.06***	.03***	-.00	-.03***

Note. The state averages of moral foundation endorsement were computed over the subsample of Whites (*N* = 58,269). * $p < .05$, ** $p < .01$, *** $p < .001$.

Table 3. Results of stratified multilevel analyses across states of the USA for non-Hispanic White respondents (N = 21,423). Final models for predicting moral foundations endorsement (Level 1) from Whites' C&G rates (Level 2), Whites' life expectancy (Level 2), Whites' teenage birth rates (Level 2), urbanization (Level 2), education (Level 1 and 2), and childhood social class (Level 1 and 2).

Moral foundation	Predictor	*b*	SE_b	*df*	*t*	*p*	Level 1 PRV	Level 2 PRV
Harm	Level 2							
	Teen births	-0.0042	0.0011	48.8	-3.80	< .001	-.0001	.5544
	Urbanization	-0.0019	0.0008	59.2	-2.31	.024	5.7×10^{-5}	.2331
	Education	0.0440	0.0381	52.8	1.15	.254	2.5×10^{-5}	.0554
	Social class	-0.2510	0.1253	66.3	-2.00	.049	-.0001	.3141
	Level 1							
	Education	0.0126	0.0029	21380	4.38	< .001	.0009	-.0024
	Social class	-0.0654	0.0080	21380	-8.16	< .001	.0031	-.0037
Fairness	Level 2							
	Teen births	-0.0049	0.0010	41.8	-4.88	< .001	-.0002	.5882
	Education	0.0770	0.0371	43.6	2.08	.044	7.6×10^{-6}	.1766
	Social class	-0.2585	0.1157	57.6	-2.23	.029	-6.1×10^{-5}	.2454
	Level 1							
	Education	0.0111	0.0025	21371	4.43	< .001	.0009	-.0025
	Social class	-0.0766	0.0070	21372	-10.94	< .001	.0056	-.0128
Ingroup	Level 2							
	C&G	-0.0007	0.0003	66.1	-2.78	.007	3.9×10^{-5}	.2204
	Teen births	0.0054	0.0014	62.7	3.91	< .001	-2.6×10^{-5}	.3909
	Education	-0.1163	0.0492	60.5	-2.36	.021	8.1×10^{-5}	.1367
	Social class	0.2138	0.1652	81.5	1.29	.199	-1.9×10^{-5}	.0786
	Level 1							
	Education	0.0038	0.0030	21385	1.26	.209	7.4×10^{-5}	.0004
	Social class	0.0324	0.0083	21385	3.90	< .001	.0007	-.0004

Authority	Level 2							
	C&G	-0.0007	0.0003	60.2	-2.73	.008	-1.2×10^{-5}	.2387
	Teen births	0.0062	0.0013	57.1	4.70	< .001	-2.0×10^{-5}	.4772
	Education	-0.0775	0.0455	48.0	-1.70	.095	6.0×10^{-5}	.0612
	Level 1							
	Education	0.0163	0.0031	21381	5.30	< .001	.0013	-.0003
Purity	Level 2							
	C&G	-0.0010	0.0004	63.5	-2.61	.011	-1.1×10^{-5}	.1921
	Teen births	0.0118	0.0020	58.4	5.89	< .001	3.3×10^{-5}	.5328
	Education	-0.1509	0.0724	55.5	-2.08	.042	2.4×10^{-5}	.1146
	Social class	-0.1964	0.2382	74.0	-0.82	.412	1.8×10^{-5}	.0101
	Level 1							
	Education	0.0135	0.0038	21380	3.57	< .001	.0006	.0001
	Social class	-0.0341	0.0106	21380	-3.23	.001	.0005	.0001

Note: b = unstandardized regression coefficient; PRV = proportion reduction in variance (Peugh, 2010); Teen births = teenage birth rate; C&G = Chlamydia and Gonorrhea rates.

Electronic Supplementary Material with EHB-13-97-R3

S1

Data were obtained from 86,296 adult visitors (43.9% female, median age = 36 years) to the website YourMorals.org in 2007–2009, who completed the Moral Foundations Questionnaire and who provided a US zip code. Individuals who did not indicate US residency or who moved to the US at 14 years of age or older were not included in this sample (cf. Graham et al., 2011).

S2

As has been observed in previous research (Graham et al., 2009), political conservatism was highly correlated with moral foundation endorsement. Correlations with political conservatism computed at the individual level (N = 75,164): Harm r = -.35, Fairness r = -.44, Ingroup r = .47, Authority r = .57, Purity r = .58 (all ps < .001). Correlations between state averages were even higher: Harm r = -.64, Fairness r = -.81, Ingroup r = .77, Authority r = .83, Purity r = .93, all ps < .001. (State averages for moral foundation scores were computed over N = 86,296; state averages of political conservatism were computed over N = 75,164.)

S3

Table S3. Correlations between the state-level predictors.

	1. C&G Whites (N = 50)	2. C&G Blacks (N = 50)	3. Life e. Whites (N = 50)	4. Life e. Blacks (N = 37)	5. Teen b. Whites (N = 50)	6. Teen b. Blacks (N = 45)
1. C&G Whites	-					
2. C&G Blacks	.34*	-				
3. Life e. Whites	-.06	-.06	-			
4. Life e. Blacks	-.23	-.18	.75***	-		
5. Teen b. Whites	.34*	.21	-.84***	-.64***	-	
6. Teen b. Blacks	-.03	.76***	-.41**	-.51**	.41**	-
7. Urbanization	-.22	-.15	.33*	.49**	-.47***	-.23

Note. * $p < .05$; ** $p < .01$; *** $p < .001$; abbreviations: C&G = Chlamydia & Gonorrhea rates; Life e. = Life expectancy; Teen b. = Teenage birth rate.

S4

Multicollinearity statistics were computed with individual-level OLS regression for which we distributed state-level variables to the individuals (cf. Bickel, 2007). VIFs for the stratified models for Whites (N = 21,423) were: C&G 1.999, Teen births 6.217, Life expectancy 4.074, Urbanization 1.830, Education (level 2) 1.931, Social class (level 2) 3.511, Education (level 1) 1.016, and Social class (level 1) 1.016. VIFs for the stratified models for Blacks (N = 1,016) were: C&G 2.665, Teen births 3.799, Life expectancy 1.374, and Urbanization 1.747.

S5

Table S5. Between-group (i.e., between-state) and within-group (i.e., within-state) variance components of null models for moral foundation scores computed for Blacks (N = 1,016).

	Between-group		Within-group	
Moral foundation	Variance component	*p*	Variance component	*p*
Harm	NA	NA	.6422	< .001
Fairness	.0006	.833	.4607	< .001
Ingroup	.0224	.124	.7829	< .001
Authority	.0378	.047	.8299	< .001
Purity	.0562	.040	1.4124	< .001

Note. NA = Could not be computed.

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